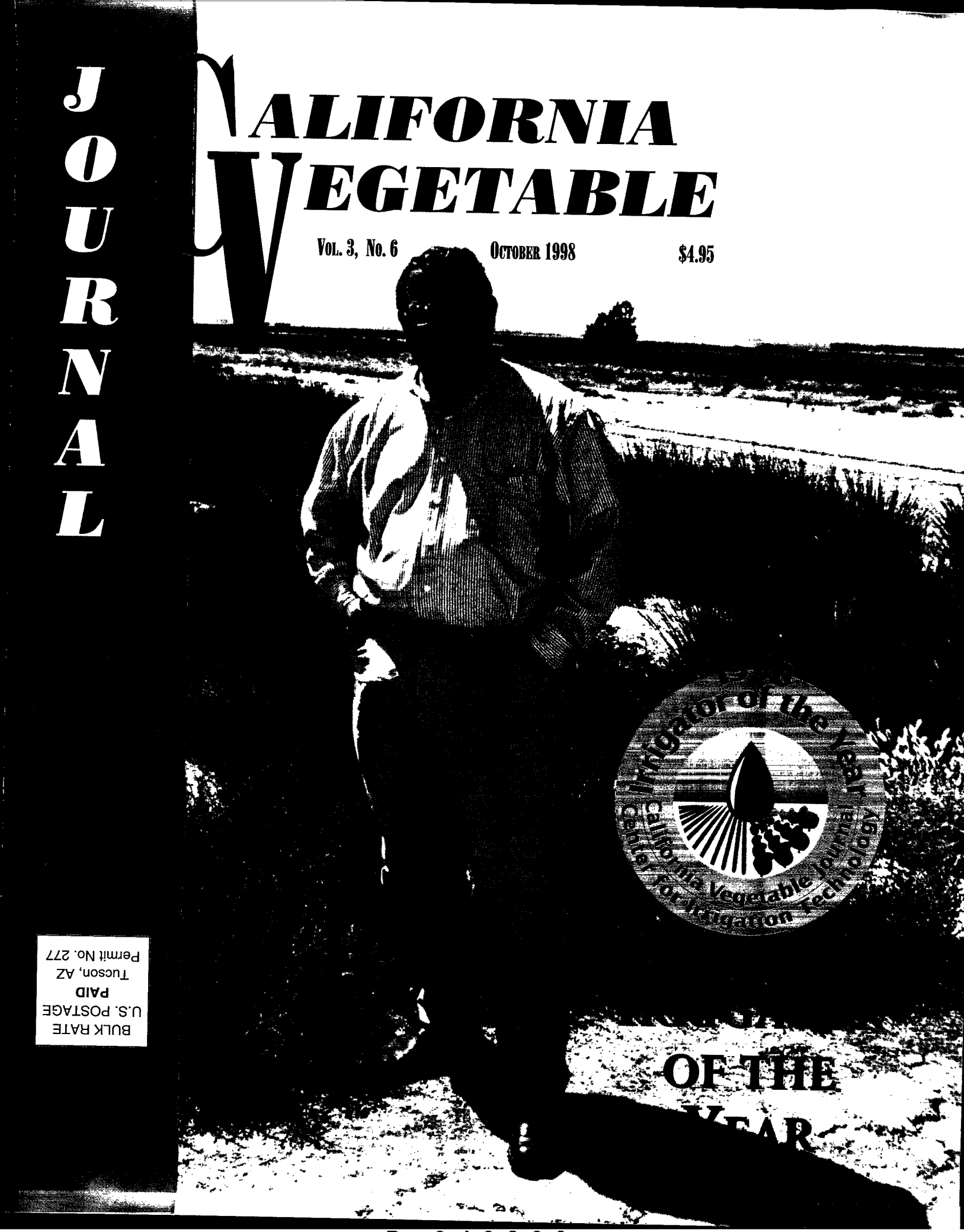
JOURNAL

CALIFORNIA VEGETABLE

VOL. 3, NO. 6 OCTOBER 1998 $4.95

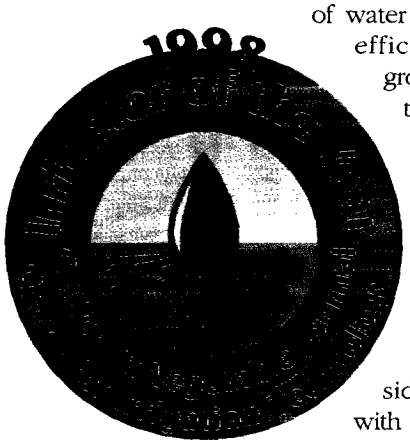


D-042803

UNCOMMON GROUND

by Willard Thompson

Irrigation management typically focuses on the application of water in order to grow crops efficiently, and rarely do growers give much thought to what happens to that water after it's applied. Therein lies a potentially serious problem that has plagued growers on the west side of the San Joaquin Valley, and other places, for years.



Thousands of Westside acres are threatened with becoming unproductive, joining acres there that have already been abandoned due to salt build up that stops plant growth. In addition, the federal government's failure to complete the San Luis Drain coupled with public concern over the selenium poisoning of migratory waterfowl around the Kesterson Wildlife Refuge have severely limited growers' drainage options.

One grower, John Diener, owner of Red Rock Ranch in Five Points, concluded the situation didn't have to be a declining spiral down to abandonment of Westside farmland. Spurred by his own business interests and a sense of stewardship for the natural resources he's farming with, Diener embarked on a decade-long reclamation project that may serve as a model for other farmers. The vision John Diener had in mind was to reclaim the land to its full fertility and then create an irrigation management regime to use and reuse virtually all irrigation water so that no off-site drainage would be necessary. His success has earned him the *California Vegetable Journal*/Center For Irrigation Technology Irrigator Of The Year award.

A Marathon Not A Sprint

John Diener's odyssey began in the mid-1980s. Following graduation from UC Davis with a degree in ag economics in the '70s, and a six year stint as a PCA, Diener began acquiring Westside farmland. In 1984, he acquired a 640-acre tract from the Southern Pacific Railroad. The land had no drainage and had so much salt intrusion that it was unfit to grow most crops. It also had a perched water table, with ground water as shallow as 10 feet below the surface.

But Diener saw the potential. He says, "This is very good dirt. This is Panoche loam soil associated with Oxalis. This is the kind of ground that once reclaimed can grow four bales of cotton or 50 tons of tomatoes (per acre) and there is nothing inherently wrong with it. I knew it was in an area where you could drill water wells and be successful."

At the time of the acquisition he was on the board of directors of the Westside Resource Conservation District, an organization working with the Soil Conservation Service (now part of the Natural Resource Conservation Service) of USDA looking for ways to assist local farmers in reclaiming land. While Diener obviously had an economic interest in the land he says, "To me it was a stewardship issue. It's not just a purely economic thing because I think we are responsible for what's been given us." The project, he adds, was intended as a means of helping other farmers find better ways to manage their resources while at the same time dealing with the salinity problems of the Westside.

San Joaquin Valley grower John Diener captures and reuses his irrigation water three times, concentrating the salt content each time. The third use is on salt tolerant crops with potential commercial use, like this trial plot of salt grass.

***Willard Thompson** is publisher of* California Vegetable Journal.

The first step in Diener's reclamation process was determining the source of the perched water table. "We had to discover whether it was our irrigation practices in being inefficient irrigators that was causing the perched water table on our land or whether it was a regional water table situation," he says. To find the answer, 25 shallow water wells were drilled at 1300 foot intervals on the land. From them a subsurface topographical map of the perched water table was developed and readings were taken from the wells every two weeks for the next several years to map seasonal flows of the perched water.

John Diener's innovative reclamation efforts have turned a salty, undrained section of Westside land into ground fit for high-value crops like broccoli.

"We found that water intrusion was a big part of our problem on this section of land because it was where the alluvial fan of one soil series overlaid another soil series that was heavier and denser, with some impervious layers that caused the water to perch. We had water coming down slope onto our property which through time and capillary action brought the salinity to the surface."

Stemming The Flow

Diener, and the consultants who began joining the project from a host of federal and state agencies as well as the University of California, concluded that the key to creating a manageable irrigation and drainage system was to stem the flow of water coming onto the land from outside sources. Leading these efforts was Vashek Cervinka of the Department of Water Resources, who Diener credits with formulating the ideas that were incorporated in the project, Frank Menezes of the Fresno office of the Natural Resource Conservation Service and Morris "Red" Martin, General Manager of the West Side Resource Conservation District, who Diener calls his mentor and elder statesman.

Their solution to the foreign water intrusion was to plant eucalyptus trees on the upslope side of the property on its western edge. Eucalyptus is a thirsty but reasonably salt tolerant tree, able to survive with water in the 8,000-10,000 parts per million (ppm) of total dissolved salts (tds) range. The perched water flowing onto the land was only at 2,000-3,000 PPM. "By having the border of eucalyptus trees and intercepting a large percentage of the regional water table problem we are dealing with only the water that we use to create the leaching fraction," Diener says.

With the flow of foreign water substantially reduced, the next step in the irrigation management process was reclaiming the fields by tiling them. Here again, Diener departed from the traditional pattern of tiling at an 8-ft depth by setting his tiles six feet deep. The benefit of this change, he says, lies in having far less tile water to deal with. "The difference in the tile system would have meant the difference between having free-running water from a regional basis around 80 percent of the time to having free running water only around 30 percent of the time," he says. "Those two feet are a whole big difference in the amount of tile water that comes out of the system that you have to deal with."

The first 150 acre field in the section (see diagram) was tiled in 1995; the second in 1996 and the third last year. Diener likes to plant alfalfa to began the reclamation process in the newly tiled fields because alfalfa needs frequent irrigation and has a relatively deep root structure that helps in a deep leaching of the irrigation water. These three fields are irrigated with Westlands district water which is relatively salt free at around 200 PPM, supplemented with 1,800-ft deep well water when necessary.

This August, the first of the tiled fields was planted to broccoli, a tremendous step forward in the reclamation process according to Diener. He estimates that soil in that field now measures around one unit of EC (electrical conductivity) which would translate to around 680 PPM of TDS. "There were 30 acres in this field three years ago when we started that didn't grow any grain. It was planted to wheat before we tiled it and we didn't even get a truckload of grain off those 30 acres. We ended up getting about a ton and half off this entire field." Not only does vegetable growing provide tangible proof of the progress the project is making in reclaiming the land, high value vegetable crops are also an economic necessity. Diener figures that reasonable returns from two years of vegetable growing can pay the infrastructure improvement costs needed on the field.

Cisterns at the low end of each of the three 150-acre tiled fields collect the irrigation runoff which by now contains about 3000 PPM of salts. Submerged pumps in the cisterns pump that water to irrigate an 120-acre field which is divided into three 40-acre blocks. Diener grows salt tolerant crops like sugar beets, cotton, alfalfa seed, some members of the mustard family and some grains on these fields, saying, "part of our program is to discover the management techniques of being able to manipulate the water so the farmer in a practical way can use it on his land growing crops that he normally would be used to growing. We don't want to bring in a whole new culture, we want to adapt it to his normal practices."

Even so, some of the experimental practices being tested by Diener are not what most people would consider normal. Take for example a variety of salt-tolerant canola brought in from India that is being grown on one of the 40-acre blocks. Essentially, the purpose of this crop is to extract selenium from the soil and put it to a productive use — in this case as an additive for ruminant animal feeds. Cattle, sheep, goats and other ruminant animals need selenium in their diets to fight off diseases. Diener says this is not only a cash crop, it is also a step in the bioremediation of the land.

He says about 80 percent of the selenium leached from

the fields during an irrigation cycle is removed by the end of that cycle. "A part of it is using crops like this canola, like sugar beets, like alfalfa and things that actually absorb a fair amount of selenium. Another thing that happens is there is bacteria that live around plant roots that have a tendency to volatilize a fair amount of selenium."

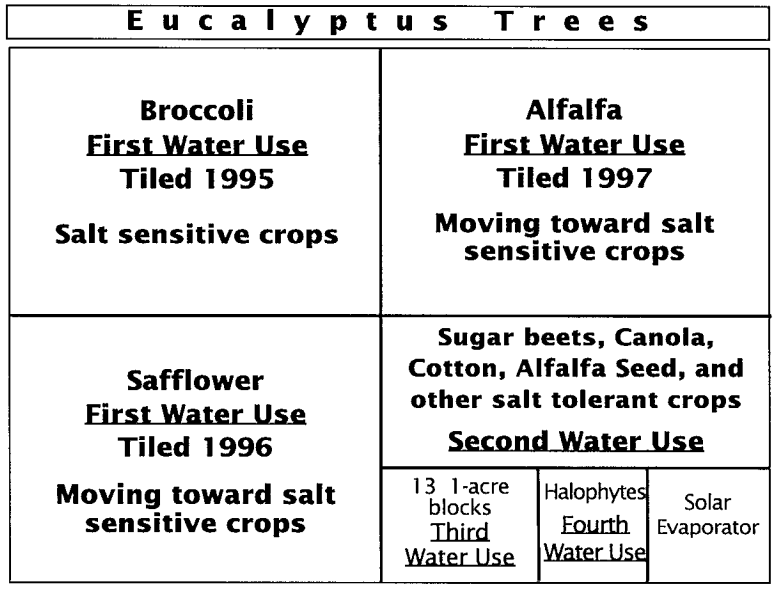
Salt of the Earth

After the second use of the irrigation water on the 120-acre field the irrigation management program's goal of concentrating the salts in the drain water is almost as important as learning what else can be grown in high salinity water. Water coming off the 120-acre field now stands at 15,000-20,000 PPM of TDS, but Diener will use it one more time, finishing with drain water that is about as salty as the ocean.

First the water is applied to 13 one-acre fields where a variety of salt-tolerant plants are growing. Originally, the reclamation plan called for planting more eucalyptus trees, but more and more the researchers and John Diener are anxious to learn what commercial crops, like purslane, which can be used in salad mixes, are possible on salty soil. From an irrigation management standpoint, the key in these one-acre plots is not to have any standing water that might attract migratory waterfowl or other animals so they are set up on solenoid timers that move water from field to field. Each field is quickly flooded, but is small enough that it absorbs the salty water quickly, before the next check gets flooded.

There is also a small experimental plot where researchers have planted a variety of halophytes, salt-loving plants like salt grass, and other potentially commercial plants.

Finally the remnants of irrigation water, now a salty brine, are directed to a solar evaporator. A time-controlled sprinkler system sprays the water onto a two-acre field covered with black plastic with the goal of achieving quick evaporation of the water leaving just the salt behind. Depending on the time of year, the sprinklers run only a few minutes each hours so that no water is left standing. In fact, Diener says the evaporator is so small that it would not attract migrating waterfowl, but the issue is moot because the timer prevents any ponding.



John Diener's ranch is designed to capture and reuse applied water, pulling salt from the soil with each irrigation. Various trial blocks explore the uses of briny water on commercial crops and a solar evaporator prevents off-site disposal.

What is left behind is salt. But John Diener is not ready to concede that even that is a waste product of his irrigation to be disposed of off-farm. He says a major amount of the research now being done is devoted to how to make the salt — sodium sulfate — a viable commercial product. Three million tons of sodium sulfate are used commercially each year in the US and 60 percent of that amount is imported, Diener says. His goal is to produce a nice clean product that can be bagged and sold to commercial users. He's not there yet, but a pilot project solar desalinator at the Westside Research Station is showing the feasibility of the concept.

In 1994, Red Rock Ranch, where John Diener also grows wine grapes and almonds in addition to melons, tomatoes, carrots, onions, garlic, string beans and wheat, received a $400,000 grant from the Bureau of Reclamation that has funded $100,000 of infrastructure improvements, with the rest going to the researchers and consultants associated with the project. Diener has invested his own money in infrastructure on the property, but he stresses that this kind of work can't be tackled for the economic return alone. "I felt that we needed a practical ways of tackling this salinity issue in the Valley and I don't think it is an insurmountable thing. I think it is something we can all work on and achieve and get done without having to export stuff to the ocean."

Indeed, there are fields surrounding Diener's incapable of producing more than one and a half bales of cotton and virtually no wheat per acre because of salt intrusion. In all, Diener estimates there are 10,000-12,000 acres in his immediate vicinity that may not be able to maintain their financing next year because they are not agronomically sound and 40,000-50,000 peripheral acres with perched water tables.

The Red Rock Ranch project may publish results of this reclamation project next year with a goal of achieving a generalized permit from government regulatory agencies so that other farmers can undertake the same reclamation process. Diener thinks the best way to approach that would be for farmers to work together reclaiming 2,400-acre blocks where not only economies of scale could be achieved but more manageable parcels for the secondary and tertiary uses of water would exist.

Diener concludes, "Some simplistic answers (to the salinity problem) are to retire the land and I say that's a simplistic answer because it's really not an answer, it's acknowledging failure in our jobs as farmers and as citizens of the United States in being good stewards of the soil and preserving what we've been entrusted with. The 600 acres that I have in this project is the first attempt by anyone to manage the water on-farm and do it in an environmentally safe as well as economically feasible way. We are proving that it can be done." ■